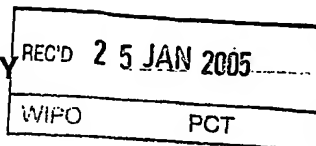


## PATENT COOPERATION TREATY



## PCT

## INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)



17 MAR 2005

Applicant's or agent's file reference P15498PC00		<b>FOR FURTHER ACTION</b> See Notification of Transmittal of International Preliminary Examination Report (Form PCT/PEA/416)	
International application No. PCT/IB 03/04186	International filing date (day/month/year) 15.09.2003 ✓	Priority date (day/month/year) 17.09.2002 ✓	
International Patent Classification (IPC) or both national classification and IPC C22B3/18			
Applicant CRUNDWELL, Frank Kenneth ✓			
<p>1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of 5 sheets, including this cover sheet. ✓</p> <p><input checked="" type="checkbox"/> This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).</p> <p>These annexes consist of a total of 1 sheets. ✓</p>			
<p>3. This report contains indications relating to the following items:</p> <p>I <input checked="" type="checkbox"/> Basis of the opinion</p> <p>II <input type="checkbox"/> Priority</p> <p>III <input type="checkbox"/> Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</p> <p>IV <input type="checkbox"/> Lack of unity of invention</p> <p>V <input checked="" type="checkbox"/> Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</p> <p>VI <input type="checkbox"/> Certain documents cited</p> <p>VII <input type="checkbox"/> Certain defects in the international application</p> <p>VIII <input type="checkbox"/> Certain observations on the international application</p>			
Date of submission of the demand 08.04.2004 ✓		Date of completion of this report 20.01.2005	
Name and mailing address of the international preliminary examining authority:  European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465		Authorized Officer Bjoerk, P Telephone No. +49 89 2399-8452 	

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT**

International application No. **PCT/B 03/04186**

**I. Basis of the report**

1. With regard to the **elements** of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17)*):

**Description, Pages**

1-11 as originally filed

**Claims, Numbers**

1-5 as originally filed  
6-13 filed with telefax on 27.08.2004

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).  
☐ the language of publication of the international application (under Rule 48.3(b)).  
☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.  
☐ filed together with the international application in computer readable form.  
☐ furnished subsequently to this Authority in written form.  
☐ furnished subsequently to this Authority in computer readable form.  
☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.  
☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:  
☐ the claims, Nos.:  
☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)).

*(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)*

6. Additional observations, if necessary:

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT**

International application No. PCT/B 03/04186

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**V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability;  
citations and explanations supporting such statement**

**1. Statement**

Novelty (N)	Yes: Claims	1-13
	No: Claims	
Inventive step (IS)	Yes: Claims	1-13
	No: Claims	
Industrial applicability (IA)	Yes: Claims	1-13
	No: Claims	

**2. Citations and explanations**

**see separate sheet**

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/IB 03/04186

1. The application relates to a method of introducing microorganisms into a heap for bio-assisted heap leaching.

The method solves the problem of poor penetration of microorganisms in a large heap by suppressing the blocking mechanism of the exopolymeric skin of the microorganisms.

2. Reference is made to the following documents:

D1: US-A-6 383 458

D2: MUNOZ J A ET AL: 'A study of the bioleaching of a Spanish uranium ore. Part I: A review of the bacterial leaching in the treatment of uranium ores' HYDROMETALLURGY, ELSEVIER SCIENTIFIC PUBLISHING CY. AMSTERDAM, NL, vol. 38, no. 1, 1 May 1995 (1995-05-01), pages 39-57, ISSN: 0304-386X

D3: MACLEOD F A ET AL: "PLUGGING OF A MODEL ROCK SYSTEM BY USING STARVED BACTERIA" APPLIED AND ENVIRONMENTAL MICROBIOLOGY, WASHINGTON,DC, US, vol. 54, no. 6, June 1988 (1988-06), pages 1365-1372, ISSN: 0099-2240

D1 is cited in the present application on page 2 and relates to bio-assisted heap leaching of sulfur-containing ore materials. In order to support the microorganisms, a nutrient solution or leachant is dripped into or sprinkled onto the heap (col.16, l.50-52). In addition, air and possibly carbon dioxide may also be sparged into the leachant solution or injected into the heap (col.19, l.17-21).

D2 discloses bioleaching of Spanish uranium ore. D2 teaches in particular that the nature of the country rock is important for an efficient leaching as it has to supply nutrients such as sulphides, iron, phosphates, nitrogen, organic substances and micro-elements (paragraph bridging pages 48 and 50).

D3 is also cited in the present application on page 2.

3. The method of claim 1 is not described neither in D1, nor D2, nor in any of the other documents cited in the International Search Report. It is known from D3 to starve microorganisms in order to suppress the exopolymer production and thus allow the microorganisms to penetrate deeper into petroleum reservoirs. By reactivation of the exopolymer production, the microorganisms are used for

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT - SEPARATE SHEET**

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International application No. PCT/IB 03/04186

plugging the reservoir. It is not seen as an obvious measure to apply this technology to the heap leaching of ores of D1 as the later aim of the microorganisms in the heap is not to plug it but to assist the leaching.

Consequently, novelty and inventive step can be recognized for the subject matter of claim 1 and by consequence for that of claims 2 to 13 which are dependent of it (Art.33(2) and (3) PCT).

4. The subject matter of claim 13 does not fulfill the requirement of Rule 6.2(b) PCT as it refers to another part of the application.

6. A method as claimed in claim 5 in which the step of exposing the microorganisms to a nutrient rich environment includes one or more of:
- a) embedding solid nutrients in the heap;
  - b) irrigating the heap with a nutrient rich solution;
  - c) aerating the heap with nutrient rich gas; and
  - d) aerating the heap with a gas enriched in carbon dioxide.
7. A method as claimed in claim 6 in which includes the step of embedding a carbon source in the heap.
8. A method as claimed in claim 7 in which the carbon source comprises carbonate.
9. A method as claimed in claim 6 in which the solid nutrients of step a) comprises slow release nutrients.
10. A method as claimed in claim 6 in which the gas of the step c) is enriched with one or more of a nutrient aerosol or ammonia.
11. A method as claimed in claim 1 in which the un-assisted re-activation includes re-activation due to one or more of prevalent conditions in the heap and natural gas flow through the heap.
12. A method as claimed in claim 11 in which the natural gas includes carbon dioxide.
13. A method substantially as herein described with reference to Example 1.